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Description

This application relates to devices for injecting liquid medicaments and, more particularly, to automatic injector types of such devices.

Automatic injectors are well known. Basically, an automatic injector is a device for enabling an individual to self-administer a dosage of a liquid medicament. An advantage of automatic injectors is that they contain a measured dosage of a liquid medicament in a sealed sterile condition capable of storage in such condition for an extensive period of non-use, during which period immediate injection of the stored dosage may be accomplished at any time under the most severe emergency conditions. Another advantage of automatic injectors is that the administration of the self-contained dosage of liquid medicament is accomplished without the necessity of the user initially seeing the hypodermic needle through which the liquid medicament is injected or of manually penetrating such a visible needle into the user's own tissue. Instead, an automatic injector includes a releasable stressed spring assembly. This assembly includes a stressed spring, a releasable mechanism for releasably retaining the spring in a stressed storage position and a releasing mechanism for releasing the releasable mechanism in response to a predetermined actuating procedure.

Automatic injectors have heretofore been particularly suited for use under emergency conditions. For example, many tens of millions of such automatic injectors have been manufactured and sold containing nerve gas antidotes for use under emergency chemical warfare conditions. Typical units which have been utilized for this purpose are disclosed in U. S. Patents 2,832,339, 3,882,863, and 4,031,893. In addition, units of this type have been proposed for use in administering antiarrhythmic medicaments under emergency conditions relating to heart attack medical situations. Such use has been in conjunction with portable monitors as is evident from the disclosure contained in U. S. Patents 3,910,260 and 4,004,577. It has, also been proposed to provide other medicaments useful in treating heart attack symptoms such as clot selective thrombolytic agents (e.g. tPA) and related medicaments. See, for example, U. S. Patents 4,689,042, 4,755,169, and 4,795,433. Finally, automatic injectors have been marketed in recent years containing a dosage of epinephrine as an antidote for counteracting severe allergic reactions, as for example, to bee stings and the like.

US-A-4 031 893, representing the nearest prior art to the present invention, describes an auto-injector comprising a medicament cartridge assembly, a releasable stressed spring assembly and means mounting said assemblies together in cooperating relation in a storage position with respect to one another so as to provide an exterior housing body structure having a needle extension and and an opposite end,

said medicament cartridge assembly including means defining a container, a liquid medicament within said container and a hypodermic needle disposed in a storage position and movable therefrom into an extended operative position,

said releasable stressed spring assembly including spring means, releasable means for retaining said spring means in a stressed storage position and releasing means operable in response to a predetermined manual actuating procedure to release said releasable means so that said spring means moves (a) said hypodermic needle into said extended operative position during which the hypodermic needle moves outwardly of the needle extension end of said housing body structures through the skin and into the adjacent tissue of a user and (b) said liquid medicament outwardly through said hypodermic needle into the tissue of the user,

wherein

the housing body structure has associated therewith a cap structure which is detachably and telescopically secured on said opposite end of the body structure and incorporates said releasing means so that the removal of said cap structure initiates said manual actuating procedure

In all of these instances, the emergency use aspect of the automatic injectors is of primary significance.

The present invention stems from the recognition that the advantages of automatic injectors are not limited only to emergency situations but that there are many other medicinal administration situations requiring a much more frequent usage where the painlessness and simplicity of actuation of an automatic injector combined with other conveniences, would be sufficiently desirable to many individuals to warrant the added costs in comparison with the more simple and less costly manual syringes in widespread use. For example, recently the drug erythropoietin has been approved by the FDA in combating anemia. The drug is particularly useful to kidney patients. aids patients, and patients donating blood for their own use in anticipation of elective surgery. Such patients may have need for the administration of erythropoietin as frequently as once a week. Another example is the recent use of various vasodialators for impotence where injection is made directly in the penis. An automatic injector provides a very convenient way of allowing the patient to administer the liquid medicament without requiring the patient to become proficient in inserting a needle into his own flesh. Under circumstances of this type, it is desirable to provide the user with maximum convenience in availability, handling, and use of the automatic injector while at the same time discouraging use by others, particularly children.

Accordingly, it is an object of the present inven-

tion to provide an auto-injector particularly suited to be carried on the person of a user comprising a medicament cartridge assembly, a stressed spring assembly and a tubular housing member mounting the assemblies together in cooperating relation in a storage position with respect to one another so as to provide an exterior housing body structure having a needle extension end and an opposite end and a cap structure extending over the opposite end of the housing body structure.

This object is achieved by an auto-injector comprising a medicament cartridge assembly, a releasable stressed spring assembly and means mounting said assemblies together in cooperating relation in a storage position with respect to one another so as to provide an exterior housing body structure having a needle extension end and an opposite end,

said medicament cartridge assembly including means defining a container, a liquid medicament within said container and a hypodermic needle disposed in a storage position and movable therefrom into an extended operative position,

said releasable stressed spring assembly including spring means, releasable means for retaining said spring means in a stressed storage position and releasing means operable in response to a predetermined manual actuating procedure to release said releasable means so that said spring means moves (a) said hypodermic needle into said extended operative position during which the hypodermic needle moves outwardly of the needle extension end of said housing body structures through the skin and into the adjacent tissue of a user and (b) said liquid medicament outwardly through said hypodermic needle into the tissue of the user,

said releasable means including manually movable means extending beyond the opposite end of said housing body structure into an exterior position suitable for manual engagement so as to be manually moved during the manual actuating procedure to which said releasing means is responsive to release said releasable means,

wherein

the housing body structure has associated therewith a cap structure having an open end and an opposite closed end portion, and means between said housing body structure and said cap structure for detachably securing said cap structure subsequently on both end of said housing body structure :

(a) during the storage position (Figure 1), in open ended telescopic relation with the opposite end of said housing body structure, covering said manually movable means so as to prevent the manual engagement of said manually movable means thereby alleviating the likelihood of an unwanted release of the releasable means with a resultant unwanted movement of said hypodermic needle and an unwanted movement of the liquid medicament outwardly of the hypodermic needle, and

(b) during the extended operating position after withdrawal from the injection site (Fig. 8) in open ended telescopic relation with a needle extension end of said housing body structure, covering said hypodermic needle so as to protect the user against an unwanted contact with the hypodermic needle.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

IN THE DRAWINGS:

Figure 1 is a longitudinal sectional view of an auto-injector embodying the principles of the present invention;

Figure 2 is an enlarged sectional view taken along the line 2-2 of Figure 1;

Figure 3 is a side elevational view of the clip component of the housing cap structure;

Figure 4 is a right end view of the clip component shown in Figure 3;

Figure 5 is an enlarged fragmentary longitudinal sectional view of the rearward end portion of the auto-injector shown in Figure 1, illustrating the position of the parts after removal of the cap structure;

Figure 6 is a view similar to Figure 5, showing the position of the parts at the time of actuation;

Figure 7 is a view similar to Figure 5, showing the position of the parts just after actuation; and

Figure 8 is an enlarged fragmentary sectional view of the forward end of the auto-injector illustrating the position of the parts after injection and the removable cap structure in its final needle-guarding position.

Referring now, more particularly, to the drawings, there is shown in Figure 1 thereof an auto-injector, generally indicated at 10, which embodies the principles of the present invention. The auto-injector includes two basic assemblies: one, a medicament cartridge assembly, generally indicated at 12, and the other, a stressed spring assembly, generally indicated at 14. These two assemblies are mounted in a storage position with respect to one another in cooperating relation by a means which includes a tubular housing member 16 which serves to receive the medicament cartridge assembly 12 in its forward end and to secure the stressed spring assembly 14 at its rearward end so as to maintain the two assemblies 12 and 14 in their storage position in cooperating relation with one another. The present invention is more particularly concerned with the construction of the stressed spring assembly 14 and, more particularly,

the construction and functions attributable to a separable cap structure, generally indicated at 18, forming a part of the stressed spring assembly 14.

The medicament cartridge assembly 12, as shown, is preferably constructed in a manner hereinafter more fully described. It will be understood that the stressed spring assembly 14 of the present invention may be utilized in other auto-injector combinations embodying types of medicament cartridge assemblies other than the preferred. As, for example, cartridge assemblies of the type embodied in Sarnoff Patent 3,396,726, dated August 13, 1968, in which the needle of the cartridge is disposed within the medicament chamber so that the medicament is moved outwardly of the chamber through the needle as the needle moves into the muscle tissue of the user. Examples of other types of medicament cartridge assemblies include multiple chamber assemblies of the type described in U. S. Patent Nos. 4,394,863, 4,529,403, 4,820,286 and 4,822,340.

The preferred illustrated type of medicament cartridge assembly 12, as shown, includes a generally cylindrical container 20 which preferably is made of glass and has its rear end open and its forward end necked down and formed with an exterior flange 22. A metal hub member, generally indicated at 24, serves to fixedly secure a rearward end portion of a hypodermic needle 26 with the flange 22 of the necked down forward end of the container 20. The hub member 24 includes a crimped down forward portion 28 which sealingly engages the exterior periphery of a rear end portion of the hypodermic needle 26. The hub member 24 includes a central portion 30 which is joined with the forward portion by a forward annular shoulder 32. The central portion 30 provides a sealed hollow interior space into which the rearward end of the needle 26 extends. As shown, the rearward end of the needle is sharpened to present a rearwardly extending point. The hub member 24 also includes a rearward portion 34 which is joined with the central portion by a rearward shoulder 36.

A diaphragm seal 38 has its outer marginal periphery mounted between the flange 22 of the necked down end of the container 20 and the rearward surface of the rearward shoulder 36 of the hub member 24. The rearward portion 34 of the hub member 24 is crimped over the exterior flange 22 of the necked down forward end of the container 20 to fixedly secure the needle 26 to the container 20.

A liquid medicament 40 is filled within the container 20 so as to be confined forwardly by the diaphragm seal 38 and rearwardly by a plunger or piston 42 which is formed of resilient material with an exterior periphery in sliding sealing engagement with the interior periphery of the container 20 in a position generally forwardly of the rear extremity thereof.

Mounted in surrounding relation to the needle 26, which extends forwardly from the crimped forward portion 28 of the hub member 24 and terminates in a forward sharpened end 44, is a resilient sheath 46. The resilient sheath 46 includes a closed forward end disposed forwardly of the sharpened end 44 of the needle 26 and a rearward end which is shaped to engage over the crimped forward portion 28 of the hub member 24. The rearward end of the sheath 46 is provided with an integral radially outwardly extending annular flange 48. An annular sheath retaining member 50 including an interior flange 52 on one end thereof is engaged on the central portion 30 of the hub member 24 so that its flange 52 engages the flange 48 of the sheath 46 so as to sealingly retain the rearward end of the sheath 46 in abutting engagement with the forward shoulder 32 of the hub member 24.

If desired, and depending upon the amount of liquid medicament included within the container 20, a spacer member (not shown) may be mounted within the rearward end portion of the container 20 rearwardly of the piston 42 in accordance with the teachings of U.S. Patent No. 4,031,893.

The spring assembly 14 which is constructed in accordance with the principles of the present invention includes a main rearward tubular housing member 54 having a forward annular ridge 56 formed on the exterior periphery thereof in rearwardly spaced relation to the forward end thereof and a rearward ridge 58 of slightly greater exterior diameter disposed in rearwardly spaced relation with respect to the forward ridge 56. The forward tubular housing member 16 has its rearward interior periphery formed with an annular groove 60 so as to enable the rearward end portion of the tubular housing member 16 to be moved rearwardly over the forward end portion of the tubular member 54 of the spring assembly 14 so as to be retained therein in a position in which the rearward extremity of the forward tubular housing member 16 engages the forward surface of the rearward annular ridge 58. The forward end portion of the forward tubular housing member 16 is of reduced diameter and has an apertured end wall 62 thereon. An injection site tubular insert 64 is fitted over the reduced end of the forward housing member 16. The insert 64, as shown in Figure 1, is constructed so as to convert the normally intramuscular injector 10 into a subcutaneous injector. Figure 7 illustrates an intramuscular type insert 66.

The interior diameter of the reduced portion of the housing member 16 is of a size sufficient to receive the closed forward exterior peripheral extremity of the resilient sheath 46 of the medicament cartridge assembly 12 when the latter is mounted within the rearward open end of the forward housing member 14. It will be noted that the rearward end of the container 20 is disposed in generally abutting relation to the forward extremity of the tubular housing member 54 of the spring assembly 14.

The tubular housing member 54 of the spring as-

sembly 14 is formed with an interior annular flange 68 spaced slightly inwardly from the rearward end thereof. The forward surface of the annular flange 68 is adapted to be engaged by a rearward volute of a coil spring 70 forming a part of the stressed spring assembly 14. The forward volute of the coil spring 70 engages a rearwardly facing surface of a forward flange 72 of a collet member, generally indicated at 74.

The collet member 74 extends rearwardly from the forward flange 72 thereof within the coil spring 70. The rearward end portion of the collet member 74 is split so as to form a plurality (two) of rearwardly extending spring fingers 76. The spring fingers 76 shown are formed with a pair of oppositely facing rearward arcuate surfaces 78 which extend from the rearward extremity thereof inwardly and a pair of forward arcuate surfaces 80 of a slightly greater radius extending forwardly therefrom. The rearward peripheral portion of the fingers 76 are formed with radially outwardly extending arcuate flanges presenting forwardly facing locking surfaces 82 which are adapted to engage along a generally radially extending plane with the rearwardly facing surface of the interior annular flange 68 of the rearward housing member 54. As shown, the locking surfaces 82 are disposed in a radial plane and the rearwardly facing surface of the annular flange 68 has a slight angular extent, as, for example, 16°. It will be noted that the rearward peripheral portions of the fingers 76 also include frustoconical rearwardly and outwardly facing surfaces that cam the fingers 76 within the flange 68 during assembly.

As shown, a safety actuating pin member, generally indicated at 84, is disposed in cooperating relation with the resilient fingers in a storage position and includes a forward portion 86 which is generally coextensive with the rearward arcuate surfaces 78 of the resilient fingers 76. The safety actuating member 84 also includes an intermediate portion 88 of a reduced diameter with respect to the forward portion 86, there being a frustoconical transition between the two portions. Formed on the forward portion adjacent the frustoconical transition is a series of annularly spaced threshold pressure inducing protrusions in the form of semi-spherical knobs 90 extending therefrom. The rearward extremity of the two spring fingers 76 of the collet member 74 are disposed forwardly of the knobs 90 and the forward extremity of the forward pin portion 86 is slightly enlarged to provide a retaining protrusion configured to enter beyond the arcuate surfaces 78 onto the surfaces 80 so as to prevent accidental rearward withdrawal of the safety actuating member 84. Finally, the safety actuating member 84 includes a rearward thumb-engaging or actuating portion 92 of an enlarged diametrical size. The thumb-engaging portion 92 is of a size to engage within a corresponding capturing recess in the rearward interior periphery of the rearward housing member 54 rearwardly of the annular flange 68. It can be seen that when the locking surfaces 82 of the spring fingers 76 are engaged with the rearwardly facing locking surface of the flange 82, the coil spring 70 is retained in a stressed condition between the forward flange 72 of the collet member 74 and the forwardly facing surface of the interior flange 68 of the housing member 54.

The rearward exterior periphery of the housing member 54 is formed with a forwardly spaced annular groove 94 which defines a rearward radially outwardly extending annular flange. As best shown in Figure 2, a segmental portion of the flange is removed, as indicated at 96, to a radially inward extent equal to the radius of the annular groove 94. The flange thus provided, which has an effective arcuate extent of approximately 300°, serves to permit the housing cap structure 18 to be retained in a storage position within the stressed spring assembly 14.

As shown, the cap structure 18 includes a first tubular member 98 which is preferably molded of a suitable plastic material in a configuration which provides a central axis. The tubular member 98 has a forwardly converging frustoconical section which terminates in a forward interior flange 100 and a rearward generally cylindrical section which terminates in a rearward interior flange 102. As best shown in Figure 2, extending rearwardly from the forward interior flange 100 within the forward frustoconical section are three equally annularly spaced guide bars 101. The radially inward extent of the rearward flange 102 is slight enabling the first tubular member 98 to be molded by two cooperating die members which are moved into cooperating relation with one another in the axial direction of the central axis provided by the tubular member 98. The two die members can then be separated by axial movement in the opposite direction.

The cap structure 18 also includes a second clip member, generally indicated at 104, which also is preferably molded of a suitable plastic material. As shown, the clip member 104 includes an elongated clip 106 having a forward end formed with a protrusion 108 which extends radially inwardly. Formed integrally with the rearward end of the clip 106 is a mounting section which includes a circular rearward wall portion 110 having an exterior dimension generally equal to the exterior dimension of the cylindrical rearward section of the tubular member 98.

As best shown in Figures 3 and 4, the mounting section of the clip member 104 includes a first arcuate wall portion 112 which extends forwardly from the rearward wall portion 110 and terminates in a radially inwardly extending lug 114 having a rearwardly facing locking surface thereon displaced 180° from the clip 106. The exterior periphery of the first arcuate wall portion 112 includes an arcuate ridge 116 having a sloping forward surface and a rearward abutting edge

surface. A second arcuate wall portion 118 extends integrally forwardly from the rearward end wall portion 110 in generally diametrically opposed relation with respect to the first arcuate wall portion 112. The second arcuate wall portion 118 likewise includes an arcuate ridge 120 on its exterior periphery which is bevelled at its forward edge and extends sharply transversely at its rearward edge.

It will be noted that the clip member 104 in the configuration described is capable of being molded by two cooperating die members which are movable toward one another into cooperating relation in a direction perpendicular to the direction of transverse alignment between the lug and clip. After molding has been accomplished, the two die members can be moved apart in the opposite direction to release the clip member 104.

The arrangement of the first and second members 98 and 104 is such that they can be moved and held into an assembled position by a relative movement toward one another in a direction along the axis of the tubular member 98. The rearward interior flange 102 of the cylindrical section of the tubular member 98 engages snugly over the exterior periphery of the two arcuate wall portions 112 and 118 and then the rearward flange 102 thereof rides up and snaps over the two exterior arcuate ridges 116 and 120, thus holding the two members 98 and 104 in assembled relation together.

The cap structure 18 is assembled in a storage position within the stressed spring assembly 14 by engaging the open forward end in telescoping relation over the rearward end portion of the rearward housing member 54. In this regard, it will be noted from Figures 1 and 2 that the exterior periphery of the rearward ridge 58 of the housing member 54 has an arrow indicia 122 embossed thereon in an annular position which is displaced 180° from the cut-off portion 96 of the annular flange. The cap structure 18 is secured in its storage position by mapping the rearward inclined surface of the lug 114 over the flange of the housing member 54. In the event that, during the securement of the cap structure 18, the forward end of the clip 106 is aligned with the indicia 122 which has the effect of aligning the lug 114 with the cut-off portion 98 of the flange of the housing member 54, it is then necessary to turn the cap structure so as to bring the rearwardly facing surface of the lug 114 into abutting relation with the forwardly facing surface of the flange defined by groove 94. It will be noted that the lug 114 rides within the annular groove 94 permitting this turning action.

The auto-injector 10 is normally carried by the user by simply slipping the auto-injector in a pocket and clipping it in a manner similar to a conventional fountain pen. In this regard, it will be noted that the auto-injector includes a housing body structure which is defined by the forward housing member 16, the rearward housing member 54 and the insert 64 or 66. The cap structure 18 is normally retained with its open end in telescoping relation over the rear end of this housing body structure by operation of the lug 114. The protrusion 108 of the clip serves to grip the fabric of the pocket so as to retain the auto-injector including the housing structure within the pocket.

Moreover, it will be noted that the engagement of the cap structure 18 on the housing body structure is such as to prevent movement of the safety actuating pin 84. The intermediate portion 88 and thumb-engaging portion 92 thereof extend rearwardly of the housing structure within the cap structure 18, thus requiring removal of the cap structure from the housing body structure before actuation of the automatic injector can take place.

Removal of the cap structure 18 from the housing body structure constitutes the first step in a predetermined manual actuating procedure for actuating the automatic injector 10. In order to remove the cap structure 18, a combination of two manual movements must be carried out. Thus, it is first necessary to turn the cap structure 18 with respect to the housing body structure until the clip 106 is aligned with the indicia 122. When the cap structure 18 has been turned into this position, the lug 114 which is diametrically opposed to the clip 106 will be disposed within the cut-off portion 96 of the flange defined by the groove 94. This enables the user to perform the second movement of the cap structure 18 which is a longitudinal rectilinear movement in a direction away from the housing body structure along its axis.

After the cap structure 18 has been thus removed, the user grasps the forward tubular housing member 16 in one hand and extends the thumb of that hand over the thumb-engaging portion 92 of the safety actuating pin member 84. The user then moves the forward surface of the insert 64 or 66 onto the injection site in engagement with the skin thereof. Next, the safety actuating pin member 84 which is in its storage position, as shown in Figure 5, is moved forwardly by a thumb pressure sufficient to overcome the threshold pressure provided by the engagement of the knobs 90 with the finger surfaces 76 until the actuating pin member reaches an actuating position, such as shown in Figure 6. The stress of the spring 70 between the annular flange 68 of the tubular housing member 54 and the forward flange 72 of the collet member 74 urges the forwardly facing locking surface 82 of the spring fingers 76 into engagement with the rearward facing surfaces of the flange 68.

So long as the forward portion 86 of the safety actuating pin member 84 is in the storage position shown in Figure 5, the spring fingers 76 cannot move transversely inwardly towards one another, thus retaining the locking surfaces in engagement. As soon as the safety actuating pin member 84 reaches the position shown in Figure 6, the spring fingers flex by

virtue of the pressure between the locking surfaces so that their rearward ends move to a position approaching the surface of the intermediate portion 88 adjacent the thumb-engaging portion 92. When the spring fingers have flexed to this extent, the locking surfaces 82 are moved off of the flange 68, allowing the collet member 74 together with the safety actuating pin member 84 to move forwardly under the action of the spring 70.

When the thumb-engaging portion 92 of the safety actuating pin member reaches the flange 68, its movement is stopped and it is captured in the recess within the end of the tubular member 54, as shown in Figure 7. However, as soon as the locking surfaces 82 have moved forwardly past the flange 68, the spring fingers 76 begin to unflex or move back into their storage position, as shown in Figure 7. In this position, the collet member 74 continues to move forwardly while the safety actuating pin member 84 is left behind in captured relation by the tubular member 54.

The collet member 74 during its forward movement engages the piston 42 and carries the piston and the entire medicament cartridge assembly 12 forwardly within the housing member 16. During this movement, the sharpened forward end 44 of the needle 26 penetrates the closed end of the rubber sheath 46, passes through the apertured wall 62 and enters the tissue at the injection site. As the forward movement of the container 20, the medicament 40 and the piston 42 move forwardly, the sheath 46 is compressed and, as it compresses, it tends to arrest the movement of the container 20. The continued forward movement of the piston 42 with the collet member 74 pressurizes the liquid medicament 40 causing the diaphragm seal 48 to bulge out and be punctured by the rearward point of the needle 26. The liquid medicament 40 then flows into the central hub portion 30 through the needle 26 and into the tissue at the injection site. The movement of the piston 42 will continue until it reaches the necked down forward end of the container 20.

After the injection has thus been completed, the user withdraws the automatic injector and then places the cap structure 18 over the extended hypodermic needle 26, as shown in Figure 8, until the inner flange 100 reaches the flared out rearward portion of the insert 66 (or 64). In this way, the cap structure 18 provides the additional function of protecting personnel from engagement with the exposed hypodermic needle 26.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing preferred specific embodiment has been shown and described for the purpose of this invention and is subject to change without departure from such principles.

Claims

1. An auto-injector (10) comprising a medicament cartridge assembly (12), a releasable stressed spring assembly (14) and means mounting said assemblies together in cooperating relation in a storage position with respect to one another so as to provide an exterior housing body structure (16) having a needle extension end (64) and an opposite end, (54),

said medicament cartridge assembly including means defining a container (20), a liquid medicament (40) within said container and a hypodermic needle (26) disposed in a storage position and movable therefrom into an extended operative position,

said releasable stressed spring assembly (14) including spring means (70), releasable means (86) for retaining said spring means in a stressed storage position and releasing means (92) operable in response to a predetermined manual actuating procedure to release said releasable means so that said spring means (70) moves (a) said hypodermic needle (26) into said extended operative position during which the hypodermic needle moves outwardly of the needle extension end of said housing body structures (16) through the skin and into the adjacent tissue of a user and (b) said liquid medicament outwardly through said hypodermic needle (26) into the tissue of the user,

said releasable means (86) including manually movable means (84) extending beyond the opposite end (54) of said housing body structure (16) into an exterior position suitable for manual engagement so as to be manually moved during the manual actuating procedure to which said releasing means is responsive to release said releasable means,

wherein the housing body structure (16) has associated therewith a cap structure (18) having an open end and an opposite closed end portion, and means (100) between said housing body structure (16) and said cap structure (18) for detachably securing said cap structure subsequently on both ends of said housing body structure :

(a) during the storage position (Figure 1), in open ended telescopic relation with the opposite end portion of said housing body structure (16), covering said manually movable means (84) so as to prevent the manual engagement of said manually movable means thereby alleviating the likelihood of an unwanted release of the releasable means with a resultant unwanted movement of said hypodermic needle (26) and an unwanted movement of the liquid medicament outwardly of the hypodermic needle, and

(b) during the extended operating position after withdrawal from the injection site (Fig. 8), in open ended telescopic relation with the needle extension end (64) of said housing body structure (16), covering said hypodermic needle (26) so as to protect the user against an unwanted contact with the hypodermic needle (26).

2. An auto-injector as defined in claim 1 wherein said cap structure (18) has an elongated clip (104) fixed at one end thereof to said cap structure operable when said cap structure (18) is in the storage position thereof to serve to secure the cap structure (18) and housing body structure (16) within the pocket of a user.

3. An auto-injector as defined in claim 4 wherein said releasable means (86) comprises a collet member (74) having a plurality of annularly spaced elongated fingers (76) connected with the rearward end portion thereof for radially inward movement from a collet retaining position into a collet releasing position said fingers (76) having exterior locking surfaces (82) on outer portions thereof, cooperating locking surface means (68) on said rearward housing member engaging said exterior locking surfaces for (1) retaining (a) said collet member (74) against forward movement and (b) said spring means (70) in stressed condition when said releasable means (86) is in said storage position and (2) for enabling the stressed condition of said spring means (70) to effect (a) radially inward movement of said fingers (76) and (b) forward movement of said collet member (74) in response to the movement of said actuating member (84) into said actuating position.

4. An auto-injector as defined in claim 3 wherein said fingers (76) having interior releasing surfaces (80), said actuating member (84) including (1) a forward portion (86) having exterior surface means engaging said interior releasing surfaces (80) when said actuating member is in said storage position, (2) a rearward portion (92) spaced rearwardly of said forward portion for engagement by the thumb of the user, and (3) a slender intermediate portion (88) connected between said forward portion and said rearward portion.

5. An auto-injector as defined in claim 4 wherein said actuating member (84) includes protrusions (90) extending slightly outwardly from the rearward end of said forward portion (86) engageable to provide a slight threshold resistance to movement.

6. An auto-injector as defined in claim 5 wherein said fingers (76) have rear ends free from one another enabling the free rear ends of said fingers to flex inwardly, said locking surfaces (82) and said locking surface means (68) being disposed in a generally radially extending plane when engaged.

7. An auto-injector as defined in claim 1 wherein said means for detachably securing said housing cap structure (18) is operable to enable said housing cap structure to be manually detachable from secured relation with said rearward housing member (54) only by the application of two different manual movements relatively therebetween.

8. An auto-injector as defined in claim 7 wherein the two manual actions enabling said housing cap structure (18) to be manually detached from secured relation with said rearward housing member (54) by said means for detachably securing said housing cap structure (18) comprises a combination of (1) a relative turning movement and (2) a relative longitudinal movement in a direction to move the cap structure (18) and housing body structure (16) apart.

9. An auto-injector as defined in claim 8 wherein said cap structure (18) comprises a first tubular member (98) having an open end and an opposite end and a tubular axis extending therebetween,

a second clip member (104) including an elongated clip (106) and having an attaching portion integral with one end of said elongated clip, a pocket engaging portion integral with an opposite free end of said elongated clip,

said first (98) and second members (104) being disposed in a fixed assembled position with respect to one another into which said first and second members are moved by a relative movement toward one another in a direction along said tubular axis and wherein (1) said attaching portion and said pocket engaging portion project from the respective ends of said clip in a direction toward the tubular axis and (2) said attaching portion of said second clip member (104) is secured to the opposite end of said first tubular member (98),

said attaching portion having an integral lug (114) thereon displaced annularly approximately 180° from said clip (106) with respect to said tubular axis and projecting toward said clip,

said first tubular member (98) having surfaces defining the entire configuration thereof molded by corresponding die surfaces contained on two die members movable together and apart in directions along said tubular axis,

said second member (104) having surfac-

es defining the entire configuration thereof including a cap mounting surface (100) on said lug (114) facing toward the opposite end of said first tubular member (98) molded by corresponding die surfaces contained on two die members movable together and apart with respect to said second member (104) in a direction generally perpendicular to the direction of projection of said lug (114) toward said clip, said cap mounting surface (100) constituting the means on said cap structure (18) for securing the same to said rearward housing member (54).

Patentansprüche

1. Selbst-Injektionsspritze (10), die umfaßt: eine Medikamentenpatronen-Baueinheit (12), eine auslösbare gespannte Federbaueinheit (14) und ein Mittel, um diese Baueinheiten zusammenwirkfähig in einer Bereitschaftsstellung bezogen aufeinander zu montieren, um auf diese Weise eine äußere Gehäusekörperkonstruktion (16) zu bilden, die ein Nadelausfahrende (64) und ein gegenüberliegendes Ende (54) hat,

wobei diese Medikamentenpatronen-Baueinheit ein Mittel beinhaltet, das einen Behälter (20), ein flüssiges Medikament (40) in diesem Behälter und eine Injektionsnadel (26) definiert, die in einer Bereitschaftsstellung angeordnet sind und daraus in eine ausgefahrene Funktionsstellung bewegt werden können,

wobei diese auslösbare gespannte Federbaueinheit (14) beinhaltet: ein auslösbares Mittel (86), um das Federmittel in einer gespannten Bereitschaftsstellung zu halten und ein Auslösemittel (92), das als Reaktion auf eine vorbestimmte manuelle Betätigungsprozedur betätigt werden kann, um das auslösbare Mittel auszulösen, so daß das Federmittel (70) (a) die Injektionsnadel (26) in die ausgefahrene Funktionsstellung, während welcher sich die Injektionsnadel aus dem Ausfahrende der Gehäusekörperkonstruktion (16) heraus durch die Haut und in das angrenzende Gewebe eines Nutzers bewegt und (b) das flüssige Medikament nach außen durch die Injektionsnadel (26) in das Gewebe des Nutzers bewegt,

wobei das auslösbare Mittel (86) ein manuell bewegliches Mittel (84) beinhaltet, das sich über das gegenüberliegende Ende (54) der Gehäusekörperkonstruktion (16) hinaus in eine äußere Stellung erstreckt, die für ein manuelles Eingreifen geeignet ist, so daß es während der manuellen Betätigungsprozedur, auf welche das Auslösemittel reagiert, um das auslösbare Mittel auszulösen, manuell bewegt werden kann,

wobei der Gehäusekörperkonstruktion (16) eine Kappenkonstruktion (18) zugeordnet ist, die ein offenes Ende und einen gegenüberliegenden geschlossenen Endteil hat und sie ein Mittel (100) zwischen der Gehäusekörperkonstruktion (16) und der Kappenkonstruktion (18) hat, um die Kappenkonstruktion anschließend an beiden Enden der Gehäusekörperkonstruktion zu befestigen:

(a) während der Bereitschaftstellung (Fig. 1) in teleskopartigem Zustand mit offenem Ende bezogen auf das gegenüberliegende Ende der Gehäusekörperkonstruktion (16), wodurch das manuell bewegliche Mittel (84) abgedeckt wird, um auf diese Weise das manuelle Eingreifen des manuell beweglichen Mittels zu verhüten und dadurch die Wahrscheinlichkeit eines ungewollten Auslösens des auslösbaren Mittels mit einer sich daraus ergebenden ungewollten Bewegung der Injektionsnadel (26) und einer ungewollten Bewegung des flüssigen Medikaments aus der Injektionsnadel heraus zu mildern, und

(b) während der ausgefahrenen Funktionsstellung nach dem Zurückziehen vom Injektionsort (Fig. 8) in teleskopartigem Zustand mit dem offenen Ende (64) bezogen auf ein Nadelausfahrende der Gehäusekörperkonstruktion, die die Injektionsnadel (26) abdeckt, um auf diese Weise den Nutzer vor einem unerwünschten Kontakt mit der Injektionsnadel (26) zu schützen.

2. Selbst-Injektionsspritze, nach Anspruch 2, wobei die Kappenkonstruktion (18) eine längliche Klammer (104) hat, die an einem Ende davon an der Kappenkonstruktion befestigt ist und dann betätigt werden kann, wenn diese Kappenkonstruktion (18) sich in der Bereitschaftsstellung davon befindet, um dazu zu dienen, die Kappenkonstruktion (18) und die Gehäusekörperkonstruktion (16) innerhalb der Tasche eines Nutzers zu befestigen.

3. Selbst-Injektionsspritze, nach Anspruch 2, wobei das auslösbare Mittel (86) ein Spannhülsenelement (74) umfaßt. das eine Vielzahl von ringförmig in einem Abstand voneinander angeordneten länglichen Fingern (76) hat, die mit dem hinteren Ende davon für eine radial nach innen gerichtete Bewegung von einer Spannhülsen-Haltestellung in eine die Spannhülse freigebende Stellung verbunden sind, wobei diese Finger (76) äußere Verriegelungsflächen (82) an außenliegenden Teilen davon haben, damit zusammenwirkende verriegelnde Flächenmittel (68) an dem hinteren Gehäuseelement, die mit den äußeren Verriegelungsflächen in Eingriff kommen, um (1) (a) das Spannhülsenelement (74) gegen eine Vorwärts-

bewegung und (b) das Federmittel (86) in gespanntem Zustand zu halten, wenn sich das auslösbare Mittel in der Bereitschaftsstellung befindet und (2) um zu ermöglichen, daß der gespannte Zustand des Federmittels (70) (a) eine radial nach innen gerichtete Bewegung der Finger (76) und (b) eine Vorwärtsbewegung des Spannhülsenmittels (74) als Reaktion auf die Bewegung des Betätigungsmittels (84) in die Betätigungsstellung zu bewerkstelligen.

4. Selbst-Injektionsspritze nach Anspruch 3, wobei die Finger (76) innere Auslöseflächen (80) haben und das Betätigungselement (84) beinhaltet: (1) einen vorderen Teil (86), der äußere Flächenmittel hat, die mit den inneren Auslöseflächen (80) in Eingriff kommen, wenn das Betätigungsmittel sich in der Bereitschaftsstellung befindet, (2) einen hinteren Teil (92) in einem gewissen Abstand von dem vorderen Teil für einen Eingriff mit dem Daumen des Nutzers und (3) einen schlanken Zwischenteil (88), der zwischen dem vorderen Teil und dem hinteren Teil eingesetzt ist.

5. Selbst-Injektionsspritze nach Anspruch 4, bei welcher das Betätigungselement (84) Vorsprünge (90) einschließt, die geringfügig nach außen von dem hinteren Ende des vorderen Teils (86) reichen und in Eingriff kommen können, um für einen geringfügigen Schwellenwiderstand gegen eine Bewegung zu sorgen.

6. Selbst-Injektionspritze nach Anspruch 5, bei welcher die Finger (76) ein hinteres Ende haben, das frei voneinander ist und es möglich ist, daß die freien hinteren Enden der Finger sich nach innen biegen, wobei die Verriegelungsflächen (82) und das Mittel zum Verriegeln der Flächen (68) in einer sich generell radial erstreckenden Ebene angeordnet sind, wenn sie in Eingriff stehen.

7. Selbst-Injektionsspritze nach Anspruch 1, wobei das Mittel für das lösbare Befestigen der Gehäusekappenkonstruktion (18) betätigt werden kann, um in die Lage zu versetzen, die Gehäusekappenkonstruktion manuell von der Befestigung an dem hinteren Gehäuseelement nur durch das Aufbringen von zwei verschiedenen manuellen Bewegungen relativ zwischen diesen zu lösen.

8. Selbst-Injektionsspritze nach Anspruch 7, wobei die beiden manuellen Handlungen, die in die Lage versetzen, die Gehäusekappenkonstruktion (18) manuell aus dem befestigten Zustand bezogen auf das hintere Gehäuseelement (54) durch das Mittel zum lösbaren Befestigen der Gehäusekappenkonstruktion (18) zu lösen, eine Kombination von (1) einer relativen Drehbewegung und (2) einer relativen Längsbewegung in einer Richtung umfassen, um die Kappenkonstruktion (18) und die Gehäusekonstruktion (16) voneinander weg zu bewegen.

9. Selbst-Injektionsspritze nach Anspruch 8, wobei die Kappenkonstruktion (18) umfaßt:

ein erstes röhrenförmiges Element (98), das ein offenes Ende und ein gegenüberliegendes Ende und eine sich dazwischen erstreckende röhrenförmige Achse hat,

ein zweites Klammerelement (104), das eine längliche Klammer (106) hat, die einen daran befestigten Teil hat, der untrennbar mit einem Ende der länglichen Klammer verbunden ist, einen in eine Tasche eingreifenden Teil, der untrennbar mit einem gegenüberliegenden freien Ende der länglichen Klammer verbunden ist,

wobei das erste (98) und das zweite Element (104) in einer festen zusammengebauten Lage bezogen aufeinander angeordnet sind, in welche das erste und das zweite Element durch eine relative Bewegung in Richtung aufeinander zu in einer Richtung entlang der röhrenförmigen Achse bewegt werden kann und wobei (1) der befestigte Teil und der in die Tasche eingreifende Teil von dem entsprechenden Ende der Klammer in einer Richtung zur röhrenförmigen Achse hin vorstehen und (2) der befestigte Teil des zweiten Klammerelements (104) an dem gegenüberliegenden Ende des ersten röhrenförmigen Elements (98) befestigt ist,

wobei der befestigte Teil einen damit untrennbar verbundenen Ansatz (114) an demselben hat, der im Winkel um ungefähr 180° von der Klammer (106) bezogen auf die röhrenförmige Achse verschoben ist und in Richtung auf die Klammer vorsteht,

wobei das erste röhrenförmige Element (98) Flächen hat, die die gesamte Gestalt davon definieren, die durch zwei entsprechende Formflächen geformt worden sind, die an zwei Formflächen angeordnet sind, die in Richtungen entlang der röhrenförmigen Achse zusammen- und auseinandergeschoben werden können,

wobei das zweite Element (104) Flächen hat, die die gesamte Gestalt davon einschließlich einer Kappenmontagefläche (100) an dem Ansatz (114) definieren, die zu dem entgegengesetzten Ende des ersten röhrenförmigen Elementes (98) hin zeigen, geformt durch entsprechende Formflächen, die an zwei Formelementen enthalten sind, die bezogen auf das zweite Element (104) aufeinander zu und voneinander weg in einer Richtung generell senkrecht zur Vorspringrichtung des Ansatzes (114) zu der Klammer hin beweglich sind, wobei diese Kappenmontagefläche (100) das Mittel an der Kappenkon-

struktion (18) für die Befestigung derselben an dem hinteren Gehäuseelement (54) bildet.

Revendications

1. Dispositif d'auto-injection (10) comportant un ensemble formant cartouche de médicament (12), un ensemble de ressort comprimé pouvant être libéré (14) et des moyens pour réunir en coopération lesdits ensembles dans une position de stockage l'un par rapport à l'autre de manière à constituer une structure de corps de boîtier extérieur (16) possédant une extrémité (64) de prolongement d'aiguille et une extrémité opposée (54),

   ledit ensemble formant cartouche de médicament comprenant des moyens définissant un récipient (20), un médicament liquide (40) à l'intérieur dudit récipient et une aiguille hypodermique (26) disposée dans une position de stockage et déplaçable depuis celle-ci dans une position active déployée,

   ledit ensemble de ressort comprimé (14) pouvant être libéré comprenant un moyen formant ressort (70), un moyen libérable (86) pour retenir ledit moyen formant ressort dans une position de stockage à l'état comprimé et un moyen de libération (92) actionnable en réponse à une procédure de manoeuvre manuelle prédéterminée pour libérer ledit moyen libérable de sorte que ledit moyen (70) formant ressort déplace (a) ladite aiguille hypodermique (26) dans ladite position active déployée durant laquelle l'aiguille hypodermique se déplace à l'extérieur de l'extrémité de prolongement d'aiguille de ladite structure de corps de boîtier (16) à travers la peau et dans le tissu adjacent d'un utilisateur et (b) ledit médicament liquide vers l'extérieur à travers ladite aiguille hypodermique (26) dans le corps de l'utilisateur,

   ledit moyen libérable (86) comprenant un moyen (84) déplaçable manuellement s'étendant au-delà de l'extrémité opposée (54) de ladite structure de corps de boîtier (16) dans une position extérieure appropriée pour un contact manuel de manière à être déplacé manuellement durant la procédure d'actionnement manuelle en réponse à laquelle ledit moyen de libération libère ledit moyen libérable, dans lequel la structure de corps de boîtier (16) possède, associée avec elle, une structure de coiffe (18) possédant une extrémité ouverte et une partie terminale fermée opposée, et des moyens (100) entre ladite structure de corps de boîtier (16) et ladite structure de coiffe (18) pour fixer de façon amovible ladite structure de coiffe ultérieurement sur les deux extrémités de ladite structure de corps de boîtier :

   (a) durant la position de stockage (Figure 1), en relation télescopique à extrémité ouverte avec la partie terminale opposée de ladite structure de corps de boîtier (16), recouvrir ledit moyen déplaçable manuellement (84) de manière à empêcher le contact manuel dudit moyen déplaçable manuellement, réduisant ainsi la probabilité d'un dégagement ininterntionnel du moyen libérable avec un déplacement indésirable résultant de ladite aiguille hypodermique (26) et un mouvement ininterntionnel du médicament liquide à l'extérieur de l'aiguille hypodermique, et

   (b) durant la position active déployée après retrait de l'endroit d'injection (Figure 8), en relation télescopique à extrémité ouverte avec l'extrémité de prolongement de l'aiguille (64) de ladite structure de corps de boîtier (16), recouvrir ladite aiguille hypodermique (26) de manière à protéger l'utilisateur contre un contact indésirable avec l'aiguille hypodermique (26).

2. Dispositif d'auto-injection selon la revendication 1, dans lequel ladite structure de coiffe (18) possède une agrafe allongée (104), fixée à l'une de ses extrémités à ladite structure de coiffe, actionnable lorsque ladite structure de coiffe (18) se trouve dans sa position de stockage pour permettre une fixation de la structure de coiffe (18) et de la structure du corps de boîtier (16) dans la poche d'un utilisateur.

3. Dispositif d'auto-injection selon la revendication 4, dans lequel ledit moyen libérable (86) comporte un collet (74) possédant une pluralité de doigts allongés (76) espacés annulairement reliés à la partie terminale postérieure de celui-ci pour un mouvement radialement vers l'intérieur depuis une position retenant le collet vers une position libérant le collet, lesdits doigts (76) possédant des surfaces de verrouillage extérieures (82) sur leurs parties extérieures, des moyens superficiels de verrouillage (68) coopérants sur ledit élément de boîtier postérieur venant au contact desdites surfaces de verrouillage extérieures pour (1) retenir (a) ledit collet (74) à l'encontre d'un déplacement vers l'avant et (b) ledit moyen (70) formant ressort à l'état comprimé lorsque ledit moyen libérable (86) se trouve dans ladite position de stockage (2) pour décomprimer ledit moyen (70) formant ressort pour permettre (a) un mouvement radialement vers l'intérieur desdits doigts (76) et (b) un mouvement vers l'avant dudit collet (74) en réponse au mouvement dudit élément de manoeuvre (84) dans ladite position d'actionnement.

4. Dispositif d'auto-injection selon la revendication

3, dans lequel lesdits doigts (76) possèdent des surfaces de dégagement intérieures (80), ledit élément de manoeuvre (84) comprenant (1) une partie antérieure (86) possédant des moyens superficiels extérieurs coopérant avec lesdites surfaces de dégagement intérieures (80) lorsque ledit élément de manoeuvre se trouve dans ladite position de stockage, (2) une partie postérieure (92) espacée vers l'arrière de ladite partie antérieure pour un contact avec le pouce de l'utilisateur, et (3) une partie intermédiaire mince (88) disposée entre ladite partie antérieure et ladite partie postérieure.

5. Dispositif d'auto-injection selon la revendication (4), dans lequel ledit élément de manoeuvre (84) comprend des parties saillantes (90), s'étendant légèrement à l'extérieur de l'extrémité postérieure de ladite partie antérieure (86), pouvant être engagées pour assurer une légère résistance de seuil à un déplacement.

6. Dispositif d'auto-injection selon la revendication 5, dans lequel lesdits doigts (76) possèdent des parties postérieures indépendantes l'une de l'autre permettant aux extrémités postérieures libres desdits doigts de fléchir vers l'intérieur, lesdites surfaces de verrouillage (82) et lesdits moyens superficiels de verrouillage (68) étant disposés dans un plan s'étendant généralement radialement lorsqu'ils sont engagés.

7. Dispositif d'auto-injection selon la revendication 1, dans lequel lesdits moyens pour fixer de façon amovible ladite structure de coiffe du boîtier (18) sont actionnables pour permettre à ladite structure de coiffe du boîtier d'être détachable manuellement de la fixation avec ledit élément de boîtier postérieur (54) uniquement par application des deux mouvements manuels différents relativement entre eux.

8. Dispositif d'auto-injection selon la revendication 7, dans lequel les deux actions manuelles permettant à ladite structure de coiffe du boîtier (18) d'être détachée manuellement de la fixation avec ledit élément de boîtier postérieur (54) par lesdits moyens pour fixer de façon amovible ladite structure de coiffe du boîtier (18) comportent une combinaison de (1) un mouvement de rotation relatif et (2) un mouvement longitudinal relatif dans une direction pour écarter la structure de coiffe (18) de la structure de corps du boîtier (16).

9. Dispositif d'auto-injection selon la revendication 8, dans lequel ladite structure de coiffe (18) comporte un premier élément tubulaire (98) possédant une extrémité ouverte et une extrémité opposée et un axe tubulaire s'étendant entre elles,

une seconde agrafe (104) comprenant une agrafe allongée (106) et possédant une partie de fixation faisant corps avec une extrémité de ladite agrafe allongée, une partie s'engageant dans la poche faisant corps avec une extrémité libre opposée de ladite agrafe allongée,

lesdits premier (98) et second (104) éléments étant disposés dans une position assemblée fixe l'un par rapport à l'autre dans laquelle lesdits premier et second éléments sont rapprochés l'un de l'autre par un mouvement relatif dans une direction le long dudit axe tubulaire et (1) ladite partie de fixation et ladite partie s'engageant dans la poche font saillie des extrémités respectives de ladite agrafe dans une direction vers l'axe tubulaire et (2) ladite partie de fixation dudit second élément (104) d'agrafe est fixée à l'extrémité opposée dudit premier élément tubulaire (98),

ladite partie de fixation possédant une patte (114) faisant corps avec elle, décalée d'environ 180° de ladite agrafe (106) par rapport audit axe tubulaire et faisant saillie vers ladite agrafe,

ledit premier élément tubulaire (98) possédant des surfaces définissant sa configuration complète moulée par des surfaces de matrice correspondantes contenues sur deux éléments de matrice déplaçables conjointement et s'écartant dans des directions le long dudit axe tubulaire,

ledit second élément (104) possédant des surfaces définissant sa configuration complète comprenant une surface de montage de coiffe (100) sur ladite patte (114) tournée vers l'extrémité opposée dudit élément tubulaire (98) moulée par des surfaces de matrice correspondantes contenues sur deux éléments de matrice pouvant être rapprochés et écartés par rapport audit second élément (104) dans une direction généralement perpendiculaire à la direction de projection de ladite patte (114) vers ladite agrafe, ladite surface de montage de coiffe (100) constituant les moyens sur ladite structure de coiffe (18) pour fixer celle-ci audit élément de boîtier (54).

Fig. 1.

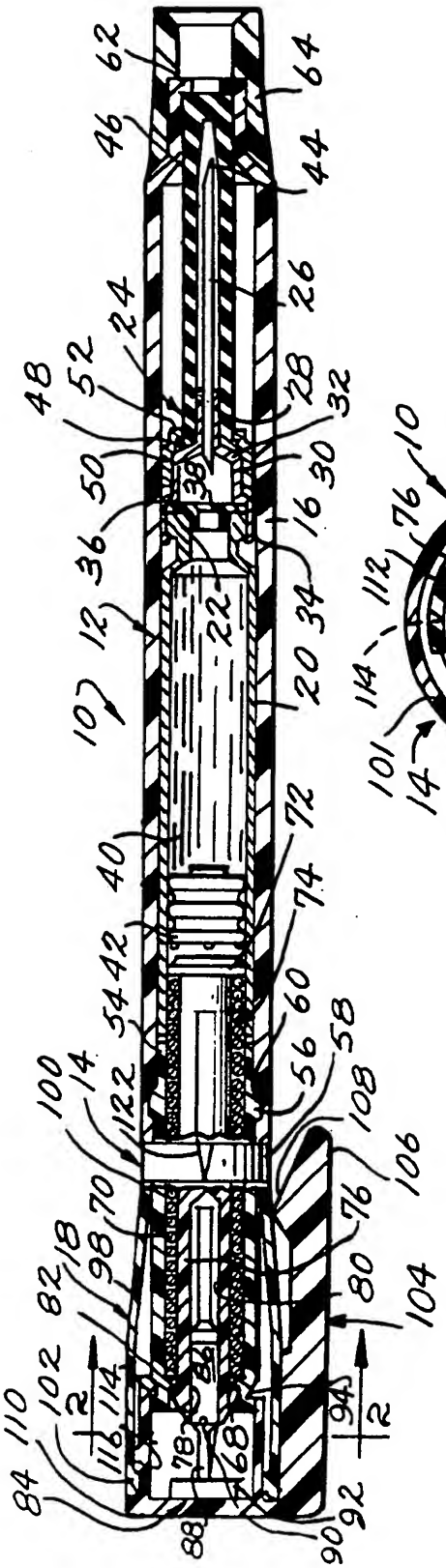
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Fig. 2.

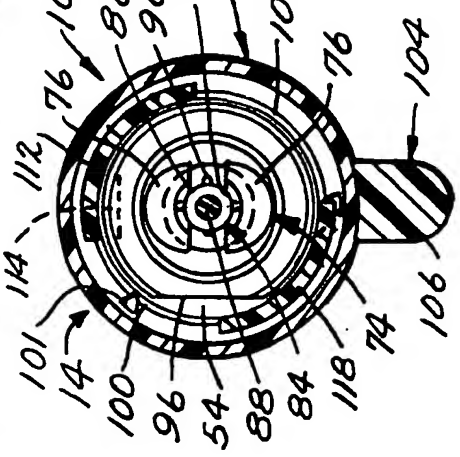
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Fig.3.

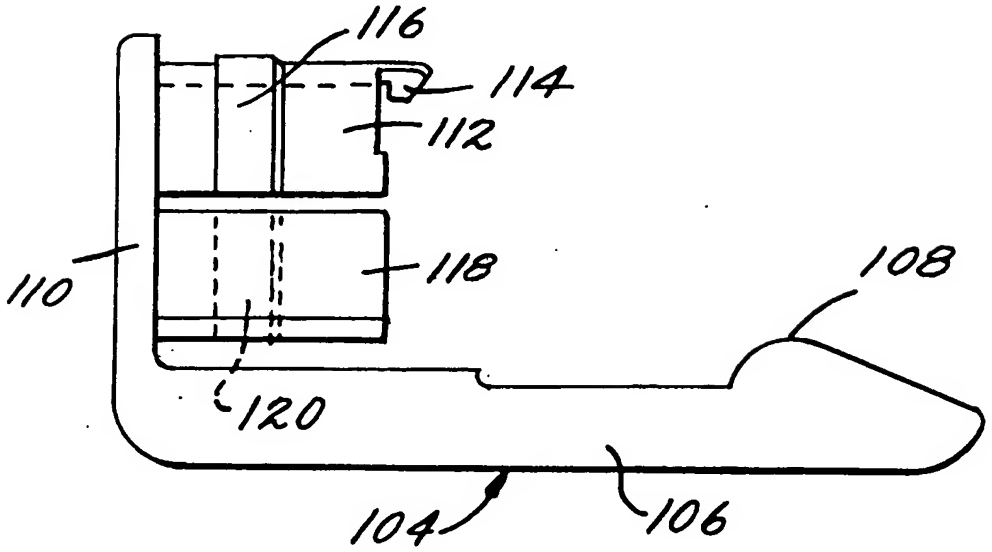
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Fig.4.

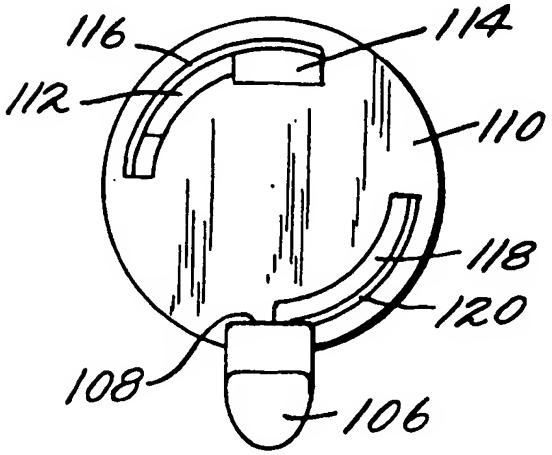
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Fig. 5.

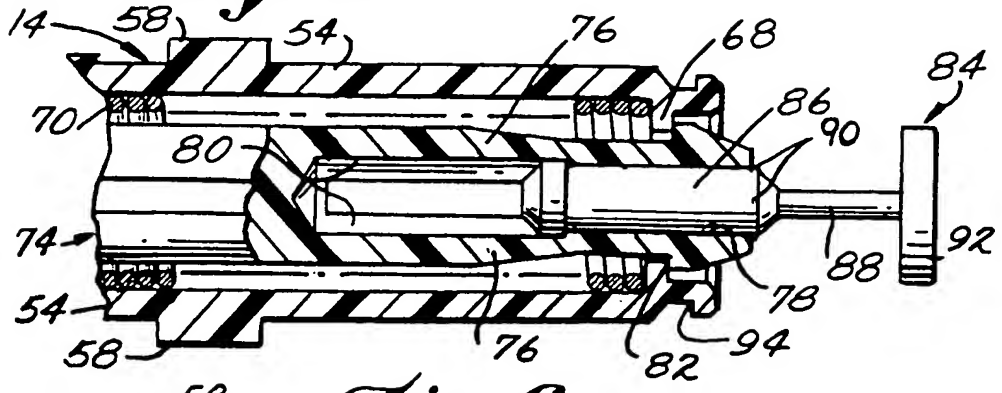
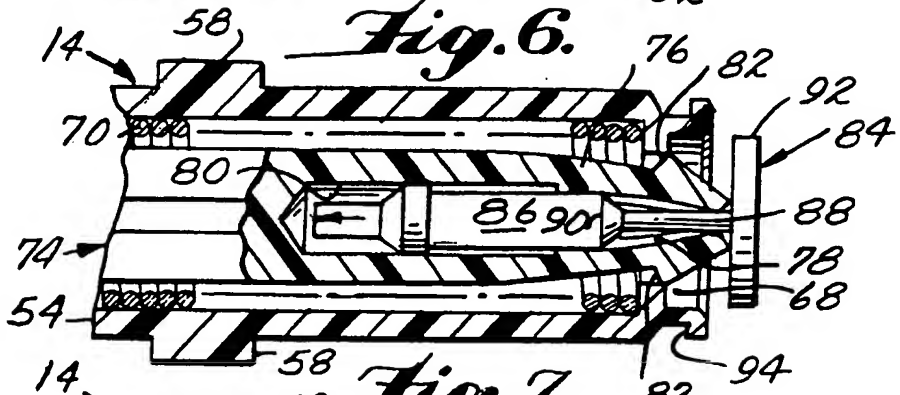


Fig. 6.



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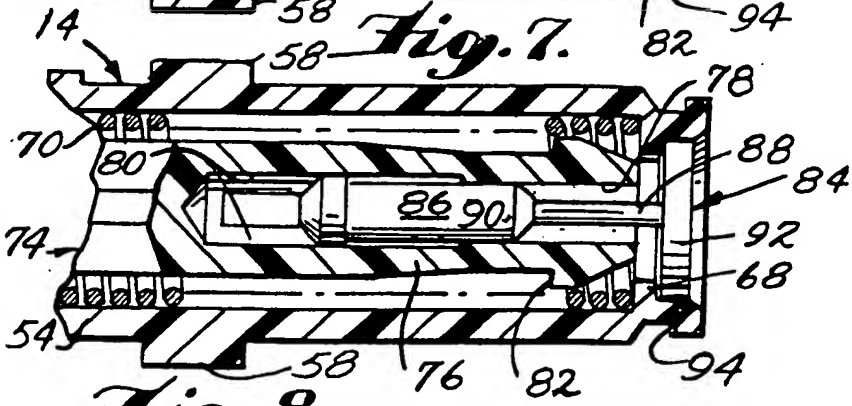

Fig. 8.